CLAIMS

1. A holographic recording method for irradiating a
recording layer of a holographic recording medium with an
object beam and a reference beam through an object optical
5   system and a reference optical system, respectively, so that a
data page is recorded thereon in the form of interference
fringes, the method comprising:

exercising control so that the object beam in the object
optical system is·reflected in an exposure direction so as to
10   be incident on the holographic recording medium or in a non-
exposure direction so as not to be incident on the holographic
recording medium selectively pixel by pixel in accordance with
the data page to be recorded; and making (N + 1) levels of
gradation exposure with a single exposure time t_1 given by
15   dividing t_0 by N, where t_0 is an exposure time necessary for
exposing an area of the recording layer corresponding to a
single pixel of the data page as much as approximately 100%,
and N is an integer of not less than 2.

2. The holographic recording method according to claim 1,
20   wherein

the reflection of the object beam in the exposure
direction or in the non-exposure direction is controlled pixel
by pixel by using a micromirror device having an array of
micromirrors corresponding to the respective pixels of the
25   data page, the micromirrors being switchable and controllable

in the direction of reflection.

3. The holographic recording method according to claim 1, wherein

the object beam is pulsed to make a pulsed exposure for

5   the single exposure time t_1 by means of any one of: pulsed

light emission from a light source of the object beam and the

reference beam; intermittent interruption of an optical path

of the object beam; and intermittent interruption of source

light of the object beam and the reference beam.

10   4. The holographic recording method according to claim 2, wherein

the object beam is pulsed to make a pulsed exposure for

the single exposure time t_1 by means of any one of: pulsed

light emission from a light source of the object beam and the

15   reference beam; intermittent interruption of an optical path

of the object beam; and intermittent interruption of source

light of the object beam and the reference beam.

5. The holographic recording method according to any one

of claims 1 to 4, wherein:

20   a beam intensity distribution of the object beam

immediately before the reflection is divided into (N + 1)

levels of areas; and the number of times of exposure for the

time t_1 within the exposure time t_0 is controlled with respect

to each of the areas so that the object beam after the

25   reflection has a generally-uniform beam intensity distribution.

6. A holographic recording apparatus comprising: a laser light source; a first polarizing beam splitter for splitting a laser beam from this laser light source into an object beam and a reference beam; an object optical system for introducing

5 the object beam to a holographic recording medium; and a reference optical system for introducing the reference beam to the holographic recording medium, wherein

the object optical system includes: a second polarizing beam splitter for transmitting or reflecting the object beam;

10 a reflection type spatial light modulator capable of intensity-modulating the object beam transmitted through this second polarizing beam splitter with respect to each of pixels of a data page to be recorded, and reflecting it in an exposure direction toward the second polarizing beam splitter

15 or in a non-exposure direction different thereto selectively; and a quarter-wave plate arranged on an optical path between the second polarizing beam splitter and the reflection type spatial light modulator,

the object beam reflected by the reflection type spatial

20 light modulator and the second polarizing beam splitter interferes with the reference beam in the holographic recording medium, and

the reflection type spatial light modulator is configured so that it is capable of at least N times of reflection within

25 an exposure time t_0, where t_0 is the exposure time necessary

22

for exposing an area of the recording layer corresponding to a single pixel of the data page as much as approximately 100%, a single exposure time t_1 is given by dividing t_0 by N, and N is an integer of not less than 2.

5   7. The holographic recording apparatus according to claim 6, wherein

the reflection type spatial light modulator is made of a micromirror device having an array of micromirrors corresponding to the respective pixels of the data page, the

10   micromirrors being switchable and controllable in a direction of reflection.

8. The holographic recording apparatus according to claim 6 or 7, wherein

the laser light source is configured so that the laser

15   light source is capable of pulsed light emission with generally the same pulse width as the single exposure time t_1 of the reflection type spatial light modulator.

9. The holographic recording apparatus according to claim 6 or 7, wherein

20   beam interrupting means for transmitting laser light with generally the same pulse width as the single exposure time t_1 of the reflection type spatial light modulator and interrupting it between pulses is interposed between the laser light source and the first polarizing beam splitter.

25   10. The holographic recording apparatus according to

23

claim 6 or 7, comprising a control unit for controlling the number of times of exposure within the exposure time t_0 with respect to each of the pixels of the reflection type spatial light modulator, and wherein

5   the control unit is configured to control the number of times of exposure within the exposure time t_0 pixel by pixel so that a beam intensity distribution after the reflection by the reflection type spatial light modulator becomes generally uniform.

10   11. The holographic recording apparatus according to claim 8, comprising a control unit for controlling the number of times of exposure within the exposure time t_0 with respect to each of the pixels of the reflection type spatial light modulator, and wherein

15   the control unit is configured to control the number of times of exposure within the exposure time t_0 pixel by pixel so that a beam intensity distribution after the reflection by the reflection type spatial light modulator becomes generally uniform.

20   12. The holographic recording apparatus according to claim 9, comprising a control unit for controlling the number of times of exposure within the exposure time t_0 with respect to each of the pixels of the reflection type spatial light modulator, and wherein

25   the control unit is configured to control the number of

times of exposure within the exposure time t_0 pixel by pixel so that a beam intensity distribution after the reflection by the reflection type spatial light modulator becomes generally uniform.

5   13. The holographic recording apparatus according to claim 10, wherein

the control unit is configured to control the number of times of exposure so that the object beam after the reflection becomes generally uniform in beam intensity, based on beam

10   intensity distribution information on each area when the beam intensity distribution of the object beam immediately before incident on the reflection type spatial light modulator is divided into (N + 1) levels of areas.

14. The holographic recording apparatus according to

15   claim 11, wherein

the control unit is configured to control the number of times of exposure so that the object beam after the reflection becomes generally uniform in beam intensity, based on beam intensity distribution information on each area when the beam

20   intensity distribution of the object beam immediately before incident on the reflection type spatial light modulator is divided into (N + 1) levels of areas.

15. The holographic recording apparatus according to claim 12, wherein

25   the control unit is configured to control the number of

times of exposure so that the object beam after the reflection

becomes generally uniform in beam intensity, based on beam

intensity distribution information on each area when the beam

intensity distribution of the object beam immediately before

5   incident on the reflection type spatial light modulator is

divided into (N + 1) levels of areas.